State of Hawaii Weatherization Assistance Program (WAP) Services – American Recovery and Reinvestment Act of 2009 (ARRA).

I. Hawaii Priority List for Installation of Energy Saving Devices

This priority list identifies energy conservation measures that will be incorporated into all household audits that receive WAP ARRA funding support. After an energy audit, each household will receive recommendations based on the findings according to the priority list. All measures approved will not necessarily go into each household; all houses are expected to go thorough the energy audit process, but there will be higher preferences for higher energy users, disabled, elderly, Hawaiians, and families with many kids.

WAP ARRA does not specify a number of energy conservation measures, just that there be a priority list. All items must have a Savings-to-Investment Ratio (SIR) of one or greater.

There is no limit, but the allowable average for each household is $6,500 for energy conservation measures and may include solar water heating, replacement of refrigerators, air conditioners, and washers, with mandatory recycling programs. All appliances must be recycled appropriately – USDOE will pay for recycling.

1. Savings-to-Investment Ratio (SIR)
SIR is a simple payback calculation that can be used to compare savings to costs of one energy system relative to an alternative energy system. For positive net savings, SIR must be greater than one. The larger the ratio, the greater the savings realized relative to the investment.

It is important to note that Hawaii has one of the highest, if not the highest, energy costs in the nation. (Energy Information Administration) With higher energy costs, there is a greater potential for energy savings across the board. The SIRs used for this report may reflect higher than normal savings in some instances because it is tailored to Hawaii's needs and costs.

In our simplified SIR calculation, future year savings were not brought back to present dollars using discount rates, fuel escalation rates, etc. because the discount rate and fuel escalation rate cancel each other out. When possible, DLIR-OCS attempted to use calculators provided by USDOE that incorporate acceptable assumptions.

2. Hawaii Priority List
Note: Every household will be treated uniquely, and not every measure will apply. This list provides significant guidance to the decision making process. However, factors in the assessment matrix for what is done in each home may include but are not limited to: 1) the safety and health of the occupants and staff, 2) household self-interests, needs, and abilities, 3) total and/or actual savings – these estimates are useful but final results may vary, 4) variations of impacts on the dwelling may act differently depending on the individual controls, behaviors, air flows, temperatures and moistures, etc.

1) Low-Flow Showerheads and Faucet Aerators SIR = 5.58 – 18.93
2) Compact Fluorescent Lights (CFLs) SIR = 6.89

3) Smart Energy Saving Power Strips SIR = 3.75 – 5.74
4) Solar Water Heater Systems SIR = 4.16
5) Refrigerator Replacements SIR = 3.94
6) Window Film SIR = 3.88
7) Room Air Conditioners SIR = 1.46
8) Residential Clothes Washers SIR = 1.45

The priority list is based on the best-estimated SIR. These SIRs will align with the goals of the State in keeping with the energy water saving plan. This plan sought for public housing by the State in March 2008 (Honolulu Advertiser, March 3, 2008) to implement cost-saving measures including but not limited to: low flush toilets and restricted water-flow showerheads, more efficient solar water heater systems, energy efficient appliances, tinted windows, CFLs and other cost-saving devices (See Attachment 1).

1). Low-Flow Showerheads and Faucet Aerators (See Attachment 2)

Approximately 50 percent of the water used in a typical household comes from bathing, while 7 to 14 percent of the water is consumed from the sink. Selecting low-flow water efficient showerheads and faucet aerators is one of the simplest and most inexpensive ways to help households significantly reduce their energy, water and sewer costs. Showerhead and faucet efficiencies are measured by the flow rate, specified as gpm.

Low-Flow Showerhead: If you have a low-flow showerhead installed, its flow rate should be 2.5 gallons per minute (gpm) or less. Federal regulations mandate that new showerhead and faucet flow rates cannot exceed more than 2.5 gpm, but today in Hawaii many homes still do not meet this requirement. In fact, before 1992 some showerheads had flow rates of 5.5gpm and are still in use today. Following these new standards and to make the energy audit feasible, showerheads with gpms equal to or greater than 2.5 can and will be replaced with a lower showerhead or faucet with a gpm of 2.0 or less, with each reducing the gpm by at least .5 gallons. (http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13050)

Inexpensive and usually simple to install, low-flow showerheads and faucet aerators can reduce home water consumption as much as 50%, and potentially reduce energy costs of heating that water by as much as 50%.

Two of the main types of low-flow showerheads our audit addresses are aerating and non-aerating.

Aerating - mixes air into the water stream. This maintains steady pressure so the flow has an even, full shower spray. Because air is mixed in with the water, the water temperature can cool down a bit towards the floor of the shower. Aerating showerheads are the most popular type of low-flow showerhead.

Non-aerating - air is not mixed into the water stream. This maintains temperature well and delivers a strong spray. The water flow pulses with non-aerating showerheads, giving more of a

massaging-showerhead effect (Low-Flow Aerators 2009 at http://www.eartheasy.com/live_lowflow_aerators.htm).

The following are assumptions used in an energy benefit calculation done by Fypower.org and use federal figures: Standard kitchen and bathroom water faucets use 4 to 7 gallons of water per minute (gpm). This means that a single incidence of washing dishes may consume up to 120 gallons of water. Non-conserving showerheads use 5 to 8 gpm, consuming up to 40 gallons of water for a single five-minute shower.

Simply installing a high-efficiency showerhead and faucet aerator will save about 7,800 gallons of water per year in an average household. An easy-to-install faucet aerator will reduce both the flow rate (from 4 to 7 gpm to 1 to 2.75 gpm) and splashing while increasing areas of coverage. This conserves water and improves faucet performance at the same time. Low-flow heads save more than 12 gallons per shower (a savings of 44% over non-conserving showerheads). Ultra-low-flow heads conserve even more, using only .8 to 1.5 gpm, reducing the average five-minute shower's water usage from 40 to 7.5 gallons.

Cost-Effectiveness Example			
Performance	Base Model[a]	Recommended Level	Best Available
Water Use Only			
Gallons per minute/cycle	2.5 gpm	2.2 gpm	1.5 gpm
Annual Water Use	18.250 gallons	16,060 gallons	10,950 gallons
Annual Water Cost	$73	$64	$44
Lifetime Water Cost	$590	$520	$350
Electric Water Heating			
Annual Energy Use	2,370 kWh	2,120 kWh	1,540 kWh
Annual Energy Cost	$142	$127	$92
Lifetime Energy Cost[b]	$1,070	$960	$690
Lifetime Energy and Water Cost Savings	-	**$200**	**$600**
Gas Water Heating			
Annual Energy Use	131 therms	120 therms	94 therms
Annual Energy Cost	$53	$48	$38
Lifetime Energy and Water Cost Savings	-	**$100**	**$350**

[a]The flow rate of the base model just meets the current Federal standards for showerheads.
[b]Lifetime energy cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed showerhead life of 10 years. Future energy price trends and a discount rate of 4.1% are based on Federal guidelines (effective from April, 1998 to March, 1999). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.
Note: Metric Conversions: 1 gallon = 3.8 liters
By reducing the demand for hot water, a household reduces the amount of energy needed to heat the water. In this way, a low-flow showerhead helps to cut the emission of 376 pounds of climate-changing carbon dioxide each year and a faucet aerator helps to prevent the release of 83 pounds of carbon dioxide per year.

Cost: Low-flow faucet aerators usually cost $5 -$10. Prices for low-flow showerheads range from less than $10 for simple, no-frills plastic ones to more than $100 for designer heads. The cost of a particular showerhead has little to do with how well it delivers a satisfying shower. Cost is more a gauge of features and the construction materials and finish.

Assuming it takes 15 minutes to order, deliver, and install a showerhead at $60/hour, it will cost an additional $15. Based on the range of the models allowed and recommended, a slightly generous cost of the showerhead for this example is $30, although it is possible and recommended to find cheaper ones. People in Hawaii can live an active lifestyle and due to the humid climate take 2-3 showers daily, more than many other parts of the United States. Moreover, because Hawaii's residents frequent outdoor activities like hiking and going to the

beach, the population that do participate in other recreational activities very easily take additional showers.

Two studies found that the average shower time of a person lasts 8 minutes. (ncbuy.com, consumerreports.com) Assuming an average person takes 1 shower/day at 8 minutes per day per year in a 4-person family, and assuming there are two showers in the household. Using a .5gpm minimum difference in replacement showerheads, we can use the following to calculate an amount of water savings.
The life cycle for a low-flow showerhead is about 10 years.
Average electric residential rate in 2008 in Honolulu was $0.2889 per kilowatt-hour (kWh) (See Attachment 3).
Average cost of water in Honolulu in 2008 is about $3/1000 gallons (See Attachment 4).
Assume cost of sewage in Honolulu is $5/1000 gallons.
Assume a 4-person household with 2 persons per showerhead per day.

0.5 gpm savings x 8 minutes x 2 persons/day x 365 days = 2,920 gallons water saved per 2-person showerhead.
2,920 gals x 250btu/gal (75 to 105F) / 3412 = 213.95 kWh x $0.2889/kWh = $61.81 savings
2,920 gals x $8/1000gals (the average cost of water and sewage in Honolulu in 2008) = $23.36 water savings

Low-Flow Showerhead SIR (without solar) = ($61.81 + $23.36) * 10 years / $45 = 18.93

Low-Flow Showerhead SIR (w/ solar) = ($6.18 + $18.93) * 10 years / $45 = 5.58

2). Compact Fluorescent Light (CFL) Replacement (See Attachment 8)
For a standard 100W incandescent equivalent, replace it with 25W CFL. A U.S. DOE report on lighting and energy use published in 2002 entitled, **"U.S. Lighting Market Characterization, Volume 1: National Lighting Inventory and Energy Consumption Estimate, Final Report"** after an extensive study and review showed for an average light bulb 2 hours/day usage independent of the type of light bulb used. Cost of CFL with tax is $3.36/bulb at Walmart Hawaii. Assuming it takes 15 minutes to order, deliver and install light bulb, as well as inform the homeowner at $60/hour, it will cost an additional $15. Assuming that a normal incandescent bulb has a life expectancy between 750 and 1,000 hours and a CFL between 7,000 and 12,000 hours (thebulb.com), then that translates into roughly 8 months and 96 months (8 years), respectively. The current price in March 2009 for residential is 19.9 cents per KWh, up to 25 cents.

Assuming that each normal bulb in the house is replaced with a 25W CFL with a savings of 75W per bulb, the dollar savings in energy can be calculated over the 8 years of savings. Still assuming the bulb is used the average 2 hours a day, everyday, for 8 years, and multiplying that by the cost per kWh (divided by 1000 to convert Wh to kWh), we estimate the energy dollar savings of each CFL to be $126.54 per bulb (shown below), with a SIR of 6.89 once those savings are divided by the cost of the new CFL bulb and the labor.

75W x 2 hours/day x 365 days/yr * 8 years / 1000 W/kW x $0.2889/kWh = $126.54

CFL SIR = $126.54/($3.36 bulb + $15 labor) = 6.89

Note: The SIR savings will change proportionately, depending on the wattage of the bulbs you are replacing. For example, in the same equation, a 60W bulb replaced with a 15W CFL will generate 40% less savings and an SIR of 40% less, to 4.14. For this audit, we assuming the majority of the replacements will be from 100W to 25W bulbs.

3). Smart Energy Saving Power Strips (See Attachment 5)
A significant savings opportunity exists for energy saving smart power strips.
Vampire plug loads (i.e. the power consumed by electronic devices while in standby or off mode) account for a significant portion of residential energy consumption. The main contributors to vampire plug loads are electronic devices that require a quick transition from off to on mode, but all electronic devices draw some electricity when in standby or off mode. According to a 2004 study by Lawrence Berkeley National Laboratory (LBNL), vampire plug load accounts for 15% of total household electricity use in California.

Take a closer look at appliances around your home. All of those little lights, clocks, and seemingly "sleeping" appliances are using more electricity than most would think. Those that use remote controls such as TVs, DVD players, ceiling fans, and stereos are suspect. Any digital displays, such as microwave and coffee machine clocks are working against your electric bill. Many of those chargers around the house–those that keep cell phones, power tools, and MP3 players ready–constantly draw power when plugged in. According to the U.S. DOE, vampire electronics can add 20% to your monthly electric bill. (Gates, Iowa Lakes Electric Cooperative)

These plug loads can be eliminated by physically unplugging electronic devices or by turning off power strips. As anyone using a power strip to power home-office setup or home entertainment system knows, it doesn't take much to get a tangle of wires, plugs and cables. Traditional power strips can eliminate vampire plug loads if they are physically turned off; this is equivalent to unplugging the devices that are plugged into it. However, most households do not turn off their power strips. A 2008 survey of California residents revealed that 90% of households do not turn off power strips used with their electronic equipment. Smart Strips eliminate the need for manual intervention by cutting power automatically. In this way, Smart Strips drastically reduce energy consumption from vampire plug loads.

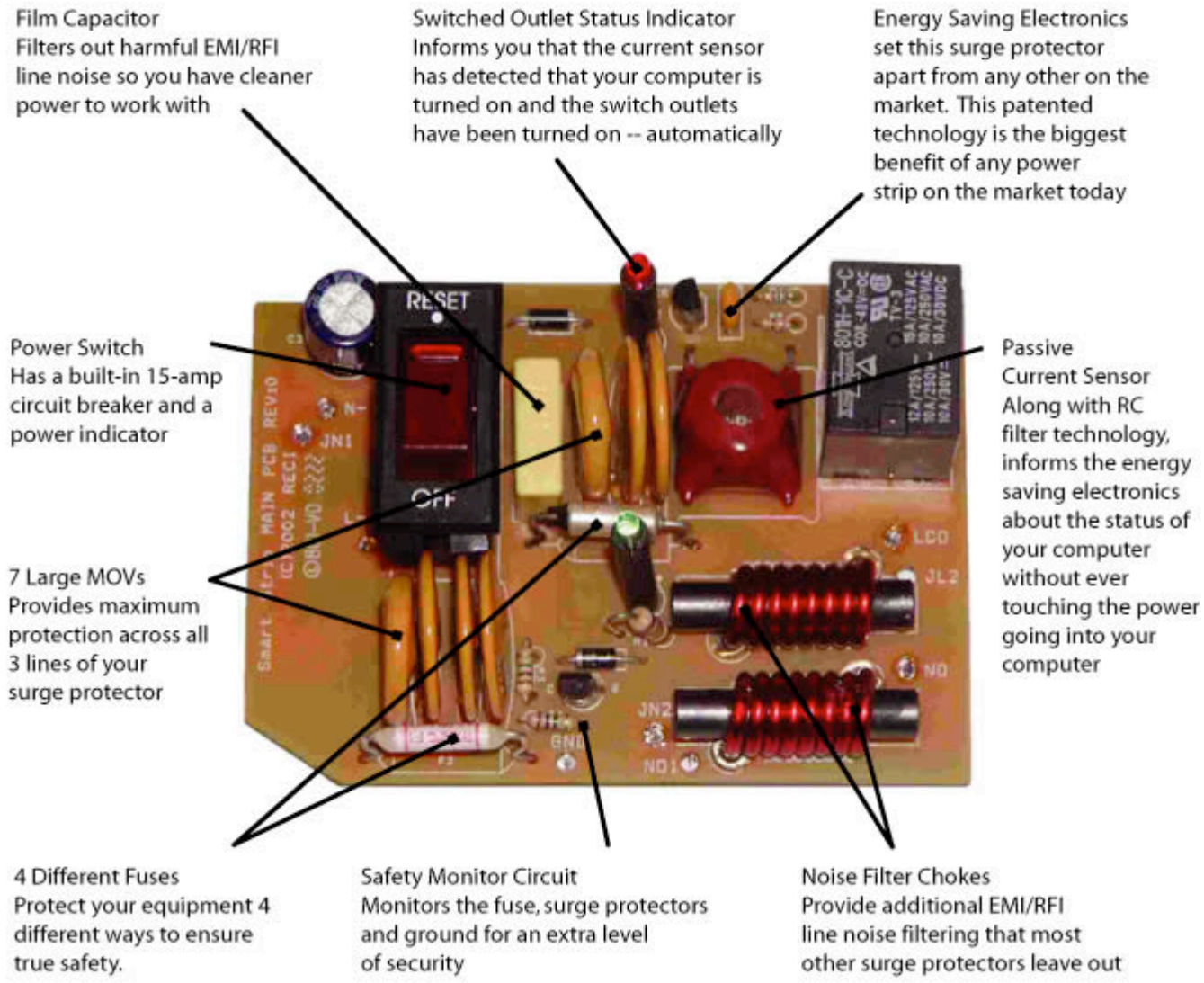
Two products that minimize vampire plug loads are the Wattstopper Plug Load Control and Smart Power Strip. Both help stop the idle current drawn from outlets when electronics aren't in use, though they employ different ways. Other products that may help minimize vampire plug loads are the Belkin Timer and Power Switch Remote, as well as other timers and power switches in the market.

Plug loads account for an increasing percentage of the total energy consumed by buildings—up to 15% in homes and 9% in commercial buildings. The Wattstopper (See attachment 6) consists of an eight-outlet power strip with surge protection and a personal occupancy sensor that utilizes the latest passive infrared technology. When the sensor detects occupancy, it turns on controlled

outlets. When the space becomes vacant, the sensor turns off these outlets automatically after the pre-set time (anywhere from 30 seconds to 30 minutes).

The Smart Strip (See Attachment 7) is a plug-in energy savings power strip that saves you money by eliminating phantom or vampire loads. It determines if power electronic devices and peripherals are on and when the Smart Strip determines that the electronic equipment is off, it automatically shuts off all peripherals, preventing them from drawing an idle current.

A small electronic device inside the Smart Strip monitors the current on a single outlet. The computer is plugged into that single outlet. When the computer is finished shutting down, the current draw from the computer drops to its idle current -- and the Smart Strip determines the current change, automatically shutting off all of the computer peripherals.



Monthly Electric Bill: 800 kWhr x $0.2889/kWhr = $231.12/month
Estimated Vampire Plug Load (up to 15%) = $34.67/month
Estimated based on HECO's Hawaii data (See Attachment 7) (home office ~$5, home entertainment ~$5, and kitchen ~$1) = ~$11 / mo.
Cost of 3 Smart Strips (one home entertainment, one home office, & one kitchen) = $120
Cost of 3 Wattstoppers Plug Control = $270
Shipping Cost: $20 - $30
Smart Strip Warranty: 2 years
Wattstopper Plug Control Warranty: 5 years
Assuming it takes 90 minutes to order, deliver and install 3 Smart Strips as well as inform the homeowner at $60/hour, it will cost an additional $90.
Assuming it takes 3 hours to order, deliver and install 3 Wattstoppers as well as inform the homeowner at $60/hour, it will cost an additional $180.
Estimated Life Cycle of a Smart Strip and Wattstopper: 10 years.

Smart Strip SIR = $11/month x 12 months/year * 10 years / $230 = 5.74

Wattstopper Plug Control SIR = $11/month x 12 months/year *10 years / $480 = 2.75

Other companies that offer occupancy sensors to control plug loads include: BITS limited, Micro Energetics and USA Technologies.

4). Solar Water Heater System

To ensure eligibility for HECO rebate, solar water heaters must provide 90% of the average annual water-heating load, perform consistently throughout the life of the system, and have an estimated useful life of at least 15-20 years with proper maintenance. DLIR-OCS did not include avoided emissions cost estimates, nor did we include the costs associated with emissions produced to generate electricity. Two more detailed studies of the US Navy and US Coast Guard installing solar water heater systems in Honolulu had SIRs of 2.5 and 2.03 respectively (See Attachment 9).

Estimated Electric Bill per Month: 800 kWhr x $0.2889/kWhr = $231.12/month
90% (solar fraction) x estimated savings of 40% hot water portion x 20 years (capital replacement costs)
Note: Although the estimated electric bill per month is 800 kWh, the contract only requires the family to have 500 kWh / month. The kWh usage may vary across areas and on different islands.

$231.12/month x 12 months/year x 20 years x 90% x 40% = $19968.77
Solar Water Heater System Cost: $4,800 (Maui Pacific Solar quoted 120 gallon systems starting at $4,300)(See Attachment 10).

Solar Water Heater System SIR = $19968.77/$4,800 = 4.16

5). Refrigerator Replacement

The refrigerator replacement program replaces old, inefficient units with efficient new ones. Over the past decade, many refrigerator manufacturers have improved the energy efficiency of their products. A typical refrigerator manufactured in 1973 used over 1,800kWh a year, but in 1993 Federal efficiency standards started requiring more efficient models that use around 1000kWh a year (Chartwell), and newer refrigerators with automatic defrost and a top-mounted freezer uses less than 500 kWh per year. (HECO's "Energy Tips and Choices Guide to Energy Efficient Homes") Replacing less efficient models with a new ENERGY STAR qualified models reduce energy costs of today's models by at least 20%, but for older models could potentially cut its energy costs up to 50%. (Energystar.com) Estimated cost for a 21 cubic foot volume top freezer refrigerator without through-the-door-ice from Best-Buy is $825. Models with top-mounted freezers utilize 10–25% less energy than bottom-mount or side-by-side models. Automatic icemakers and through-the-door dispensers increase energy use by 14–20%. (fypower.org) They also raise the purchase price by $75–250. Assumed that ENERGY STAR model 21 cubic feet configuration for top freezer is about 410 kWh versus conventional new model of 529 kWh.

Using 2008 average electricity rate, 1,285 kwh/year, and 1990-1992 top freezer refrigerator (19.0 – 21.4 cu.), it will cost $371/year to operate a refrigerator (See Refrigerator Retirement Calculator in Part 2). Replacing with an equivalent ENERGY STAR model, it will cost $118/year in energy costs. Annual savings is then $253/year. Average life of a refrigerator is 11 to 14 years. Haul away and hook-up charge is about $75.

Using 2008 average electricity rate for a conventional top-mount freezer refrigerator (21.4 cu. ft.), is estimated to use 6,342 kWh in its lifetime. Over its estimated 12 year lifecycle, the annual energy use is 528.5 kWh / yr. It costs $1,433 to operate a refrigerator in its lifetime, or $119.42/yr in energy costs. Replacing this with an equivalent ENERGY STAR model will cost $1,146 in lifetime energy costs and 5,074 kWh, or $95.50/ a year and 362.43 kWh / year. Annual savings is then $23.92/year and 105.67 kWh/year, for a total savings of 1,268 kWh and $257 in lifetime energy costs. (See Refrigerator Retirement Calculator, and assumptions, in Part 2)

Refrigerator SIR $253/year x 14 years / $900 = 3.94

6). Window Film (from panoramafilm.com)(See Attachment 11)

Windows present the easiest way for the sun's heat to enter your home. Shading provides the best cooling strategy. Overhangs, awnings and trees prevent the sun from striking the window. Where shading isn't feasible, invest in solar colored windows or window tint.

For existing glass windows, a wide variety of plastic window films can reduce heat. Applied to clear glass, window films can reduce the Solar Heat Gain Coefficient (SHGC) from around 0.9 down to as low as 0.3, together with a Visible Light Transmission (VLT) of no less than 0.4. SHGC measures the fraction of solar heat admitted through a window; the lower the SHGC, the less heat transmitted. VLT indicates the fraction of visible light admitted through a window; the higher the VLT, the more light that passes through.

Lowering the amount of ultraviolet light (UV) coming in through a window helps prevent sun damage to people, furnishings, drapes and carpeting. Applied to clear glass, window films can reduce the UV transmittal from around 71 % down to less than 1%.

Effectiveness of window films depends on: size of window glazing area; climate; window orientation; building orientation; and whether the window has interior insulation.

What are the main advantages of window film?

- A cooler house especially during a hot summer. A window film's very fine metal layer allows most of the visible light to pass through, but reflects the infrared rays back out through the glass.
- Increased safety and security (safety film): The adhesive layer of a window film reacts immediately with the inside of the window, so in the event of a window breaking, the shards of glass are held together on the film. Therefore, no glass is expelled, which prevents physical injuries and damage to the inside of your room. Safety film also makes it possible to slow down the chance of thief's breaking and entering.
- A reduction in fading. Window films keep out most of the harmful ultraviolet rays and reflect the infrared ones. This prevents or reduces the effects these rays may have on flooring, furniture, and even may help protect residents.

What are the advantages of a window film compared with an "outdoor" solar protection method?

- "Outdoor" solar protection (such as blinds or shutters) reflects the infrared rays, but it also prevents the visible light from entering the room. With window film you obtain protection against infrared and ultraviolet rays, and the maximum visible light.
- Unlike shutters and blinds, window film offers easy maintenance and no expensive cleaning.
- Window film is quick and easy to fit. Other solar protection methods involve extra work.

What are the advantages of window film compared with an "indoor" solar protection method?

"Indoor" solar protection (such as blinds or curtains) prevents the visible light from getting into the room. In addition, radiating infrared heat accumulates. Air conditioning may be a solution, however, after receiving the monthly bill, the cost or installing and running is very high compared with the window film. What's more, window film is working for you from dawn to dusk, it does not need to be mechanically closed or opened.

How does window film make the house cool?

Window film's very fine metal layer reflects the majority of the infrared rays from solar heat. During an average day, the film provides a more pleasant level of warmth in the house.

Window film reflects the heat during the summer. But what effect does the film have during the winter?

First, we must make a distinction between near and far infrared rays:

Near infrared rays are produced by the sun and

Far infrared rays can be produced by the central heating if it exists within the home.

Window film keeps out a majority of the sun's near infrared rays, and therefore also reduces the increase in temperature inside the dwelling, called solar gain or passive solar gain. However, during the winter where warmth is wanted, the window film provides limited protection against far infrared rays, due to some central heating being on. The reason for this lies in the fact that this double-glazing and/or insulation glass with a Low-Energy coating limits the additional, positive effect of the window film throughout the winter months.

For Honolulu, Hawaii, Panorama Window Films estimate a savings of:
Average Square Footage of Home: 2000 sq. ft.
Average Square Feet of Glass: 200 sq. ft.
Type of Film Used: Slate 10
Hours of Comfort Temperature: 649.7
Annual Energy Savings Provided by Manufacturer: $841.30 (up to 30% saved on energy costs)
If 30% is a bit high, use Annual Energy Savings at 21%: 800 kWh/month * $0.2889/kWh * 12months/yr * 21% efficient = $582.42
Only a few degrees in temperature reduction can have up to a 30% reduction in energy costs, due to the laws of thermodynamics. It is important to mention that this assumed reduction in energy costs comes from the savings from reducing the usage of an air conditioning unit. This saves the energy costs from the air conditioner, so in the case where none is installed, the energy savings will be greatly reduced if not eliminated (if other cooling devices such as fans are used). In addition to the energy saving benefits, solar window film can increase thermal comfort, reduce glare, while at the same time rejecting 99% of the UV radiation reducing fading and the risk of skin cancer. UV radiation from the sun is the main cause of skin cancer. Energy form the sun is a form of radiation, and UV rays damage DNA. (Ehealthmd.com)
Commercial Warranty: 16 years
Professionally installed window film costs: $3.50 -$12.00 per square foot

Window Film SIR = $582.42 x 16 years / 200 square feet * $12.00 per square feet = 3.88

7). Room Air Conditioner
A higher seasonal energy efficiency rating (SEER) makes air conditioners more efficient (energystar.com); the higher the SEER rating, the more efficient it is. The SEER rating is the total cooling output provided by the unit during its normal annual usage period divided by its total energy consumption during the same period. In January of 2006, the federal minimum efficiency standard for new central air conditioners and split systems was raised to a SEER rating of at least 13. 13+ SEER systems have lower operation costs (an air conditioner with a SEER of 13 is roughly 30% more efficient than an air conditioner with a SEER of 10), may have advanced technologies, and tend to be larger in size because more coil (tubing) is needed to reach its efficiency. (Emerson Climate) An ENERGY STAR qualified air conditioner requires its models to be at least 10% above this federal standard for all cooling capacities. To meet the regulations, air conditioning systems must be evaluated and assessed, and if needed, replaced with another system that meets the SEER rating of 13 or higher.

Sometimes, an energy efficiency ratio (EER) is used on air conditioners. Like the SEER, EER measures the cooling capacity by having Btus divided by the stead-state rate of energy input in watts, and likewise, the higher the EER, the more efficient it is. The EER standards can be

different across different types of models, so it is important to check the federal standards for each type on the Energy Star website. The difference between the SEER and the EER is that the SEER more accurately addresses efficiency on a seasonal basis while the EER addresses peak day operations. (Energystar.com) Both are important in choosing the appropriate model, but the SEER is the focus of the energy process since Hawaii has a steady 'season' all year round with temperatures from the mid 70s to the mid 80s, including summers and winters. (www.aloha-hawaii.com)

With air conditioners, size matters. A properly sized unit may take slightly longer to initially cool the space, but it will maintain a more comfortable temperature and humidity level while using less energy. High-efficiency fan motors and advanced compressors use less energy to quietly and efficiently circulate cool air.

Annual Savings (See Attachment 12)

	ENERGY STAR vs. NON-QUALIFIED MODEL			ENERGY STAR vs. 10-YEAR OLD MODEL		
	ENERGY STAR	NEW NONQUALIFIED	ANNUAL SAVINGS	ENERGY STAR	10-YEAR OLD	ANNUAL SAVINGS
ENERGY USE (kWh/yr)[2]	706	781	75	706	950	244
ENERGY BILL ($/yr)[3]	$72	$80	$8	$72	$97	$25
Adjusted HI ($/yr)	$204	$225.63	$21.6	$204	274.46	$70.46

Based on national average energy usage. Regional numbers vary widely. Energy costs based on national average electric rate of 10.19¢ from Energy Information Administration (DOE), 2006. Adjusted Hawaii numbers based on 22.89¢.

Lifetime savings of ENERGY STAR qualified room air conditioners (Lifetime savings are weighted according to regional cooling hours and electric rates) for Hawaii as calculated by the Energy Information Administration (DOE), 2006 for Hawaii is $1,145.

Worksheet lifecycle saving calculated was $1,018, which closely matches above amount of $1,145. A 12,000 BTU ENERGY STAR air conditioner costs $299. Estimated cost to install plus materials is $400.

Room Air Conditioner SIR = $1,018/ $699 = 1.46

8). Residential Clothes Washer

The average American family washes almost 400 loads of laundry each year. It's great that families can cut their related energy costs by more than a third — and the water costs by more than half — just by purchasing an ENERGY STAR clothes washer.
Is your washer over 10 years old? The life expectancy of a clothes washer is about 11 years. Replacing your old washer with a new ENERGY STAR qualified washer could save over $150 each year on your utility bills. Clothes washers manufactured before 1999 use more than four times the energy of ENERGY STAR models. Over the life cycle of a new ENERGY STAR qualified washer, one can save enough money in operating costs to pay for the matching dryer. Clothes washers that meet ENERGY STAR criteria use next generation technology to *cut energy and water consumption by over 40%* compared to conventional washers. (Energystar.gov)

Carefully consider the size of the washer you need. While a larger model will obviously hold more clothes, it will also use more energy. On the other hand, a model that's too small will require a lot more clothes washing loads. ENERGY STAR qualified models are also available in stackable and under-the-counter designs, which fit in smaller spaces.

Top-loading models look like conventional machines from the outside, but inside these ENERGY STAR qualified washers use different types of washing action to get clothes clean with less water and energy. Many have sensors to monitor incoming water temperature closely. They also rinse clothes with repeated high-pressure spraying instead of soaking them in a full tub of water.

Front-loading models are similar to machines used in laundromats. They use a horizontal or tumble-axis basket to lift and drop clothing into the water instead of rubbing clothes around a central agitator. Both top-loading and front-loading ENERGY STAR qualified clothes washers save water and energy. They also use faster spin speeds to extract more water from clothes, reducing time and energy needed in the dryer.

Comparing a conventional model ($500 purchase price, 12,614 gallons water, 803 kwH) with a front-loading ENERGY STAR model ($600 purchase price, 5,804 gallons water, 566 kwH) resulted in an annual savings of $89/year. Haul away and hook-up charge is $75.

Washer SIR = 11 years x $89 savings/year / $675 purchase cost = 1.45

While clothes dryers go hand-in-hand with clothes washers, the focus of energy savings is on clothes washers, mainly for the purpose that there are no labels for ENERY STAR clothes dryers. "There is not an ENERGY STAR label for clothes dryers because most dryers use similar amounts of energy. The Department of Energy's Appliance Standards program conducted a detailed study, which found that the clothes dryers on the U.S. market do not vary significantly from each other in terms of energy consumption. This is also the reason why the Federal Trade Commission (FTC) does not require clothes dryers to have a yellow EnergyGuide label." (ENERGY STAR website) However, simple data will be gathered alongside clothes washers when the audit is conducted.

II. Hawaii Energy Audit Process

1. How Does WAP-ARRA work? The program consists of four steps:

1) Submit application form to determine income eligibility. The USDOE Weatherization Program Notice 09-5 issued February 18, 2009 provides states with the 2009 Poverty Income Guidelines and Definition of Income for use in the Low-Income WAP.

2009 POVERTY INCOME GUIDELINES
HAWAII
EFFECTIVE JANUARY 23, 2009

Size of Family Unit	**Threshold 200%**	
1	$12,460	$24,920
2	16,760	33,520
3	21,060	42,120
4	25,360	50,720
5	29,660	59,320
6	33,960	67,920
7	38,260	76,520
8	42,560	85,120
Each additional member add	4,300	8,600

2) Have a trained inspector conduct an energy audit of the home. The energy audit assesses home energy usage and analyzes which energy conservation measures are best for your home. Inspector will assist client with questionnaire/survey.

The inspector will explain what work can be performed to the home. Also during this time, the inspector will engage the family in useful communication and education of existing machines and practices that will ensure the projected savings of switching to more energy-efficient machines. Then, a professional contractor will install the various weatherization measures. When this is complete, the inspector will return to your home to make certain that everything is satisfactory.

3) Installation of weatherization measures. What type of weatherization measures can an eligible client receive? CFLs, solar water heater system, smart energy saving power strips, low-flow faucet aerators and showerheads, window film, and ENERGY STAR appliances (refrigerator, air conditioner, and/or clothes washer).

4) A final inspection by the energy auditor or other certified professional will assure the work quality completeness and customer satisfaction.

5) Provide energy conservation education to the client.

6) Energy monitoring follow-up.

2. Energy Audit (See Attachment 13)
An energy audit process or system inspects, surveys, and analyzes energy flows or dynamics in a dwelling. Beyond simply identifying the sources of energy consumption, an energy audit prioritizes energy uses from greatest to least cost effective opportunities for energy savings.

This audit only looks at the eight prioritized weatherization measurements. It may be worthwhile investing additional time to gather further household/appliance data. This data can be input into a more complete home audit models such as the U.S. DOE Home Energy Saver Model or Microsoft Hohm – Home Profile (See Part 2 – Energy Calculators). With more data, better recommendations and additional energy saving tips can be made. This is better aligned with the WAP ARRA goals of a requisite home audit or assessment, targeting the whole-house approach, and weatherizing as much as possible each household up to the dollar limit per household.

DLIR-OCS' energy audit process consists of three parts: part 1 - the energy audit measurements as an initial assessment in the home, part 2 - energy savings calculators that can determine specific dollar and energy savings, and part 3 - weatherization measure checklists that provide tips to maximize energy savings and maintain them.

Part 1 - Energy Audit Measurements

The auditor will collect the following energy data for each of the eight weatherization measurements. The energy data collected will be input into simple calculators to estimate potential energy savings. Based on the potential energy savings calculated, the auditor will decide whether or not to implement that measure.

1. Low-Flow Showerheads and Aerators
Low-flow Showerhead: If you have a low-flow showerhead installed, its rated flow rate should be 2.5 gpm or less. Faucet: If an aerator is already installed on your faucet, it will have its rated flow imprinted on the side. This should read 2.5 gpm or lower to meet federal standards; if not, it needs to be replaced.

The US federal maximum limit of water for showerheads was lowered to 2.5gpm after 1994. Newer low-flow showerheads use less than 2.0 gpm.

Energy Data Measurements:
Average number of minutes of usage per person per day of operation _____
Number of days a year showers are taken _____
Number of showerheads to be replaced _____
What is your showerheads' current flow rate in gpm _____

To determine your present showerhead's flow rate: Place a gallon container under the head and measure the time it takes to fill it. If it fills up in 15 seconds, the flow rate is about 4 gpm. If it's full in 10 seconds, the flow rate is closer to 6 gpm. With a low-flow head, it should take 24 seconds or more.

How do you determine if you need a faucet aerator: If an aerator is already installed on your faucet, it will have its rated flow imprinted on the side. This should read 2.75 gpm or lower. Replace if over 2.75gpm. If no aerator is installed, check to see if there are threads just inside the tip of the faucet. Most modern faucets are threaded to accept aerators.

Use USDOE savings calculator to see what you can save by installing a low-flow showerhead (See Part 2 – Energy Saving Calculator).

2. Smart Energy Saving Power Strips

Vampire power is also known as standby power and phantom load. It is also referred to as vampire energy, leaking energy, wall warts, standby loss, idle current, phantom power, ghost load and vampire load. The terms refer to the electricity many gadgets and appliances waste just by being plugged in (even if they're switched off).

First take a look and monitor the energy consumed by your home office. (See chart below.)

Second take a look and monitor the energy used by your home entertainment system. (See chart below.)

Look for any other group of gadgets or appliances that could benefit from the installation of a smart energy saving power strip. (See chart below.)

You can cut your energy costs and determine what appliances are actually worth keeping plugged in. Simply connect these appliances to the Kill A WattEZ™, and it will assess how efficient they really are. Large LCD display will count consumption by the Kilowatt-hour, same as your local utility.

I keep the battery charger for my phone, electric drill, PDA, etc. plugged in continuously for convenience. How much is this costing me per month?

What is it costing me to keep my computer in an always-ready mode, sleep mode or off?

By connecting the NEW Kill A Watt EZ into these appliances you can answer all those questions automatically by the day, month or year. Price for a Kill A WattEZ is about $49.95 + shipping.

Energy Data Measurements:

Plugged in Device	Total Number of Units	Average usage in minutes or hours per day per device	Average usage per day, week, month, or year
Kitchen Appliances			
Broiler			
Coffee Machine – Drip / Percolator			

Deep Fryer			
Electric Fry Pan			
Espresso Machine			
Microwave			
Slow Cooker			
Toaster			
Toaster Over			
Entertainment			
CRT(Cathode Ray Tube) TV			
CRT Projection TV			
LCD TV			
DLP TV			
Plasma TV			
DVD Player			
VCR Player			
Cable			
Satellite Dish			
Video Game			
Audio Receiver / Tuner			
Boombox – Portable CD/Radio/Tape			
CD Player			
Tape Player			
Home Office			
Computer CPU			
Computer Monitor			
Laptop Computer Charger			
Laser Printer			
Inkjet Printer			
Router / DSL / Cable Modem			
Thermal Fax Machine			
Inkjet Fax Machine			
Home Copy Machine Time copying, and on idle			
Other Appliances			
Cordless Handheld Vacuum			
Canister Vacuum Cleaner			
Upright Vacuum Cleaner			
Aquariums			
Automobile Block Heater			
Clock			
Dehumidifier			
Doorbell			
Electric Blanket			

Electric Grill			
Electronic Air Cleaner			
Garage Door Opener			
Hair Dryer			
Heat Tape			
Humidifier			
Iron			
Pipe and Gutter Heaters			
Waterbed Heaters			
Gas Grill			
Gas Lighting			
Other			

You may use the USDOE Energy Calculator to see what your electronics' use means for your wallet by the minute, day, month and year (See Part 2 – Energy Saving Calculator).

3. Compact Fluorescent Lights (CFLs)

Tell us how many standard, fluorescent, and CFL fixtures you have in each part of your home. An efficient lighting system uses CFLs and/or fluorescent lamps as the primary light source and selectively uses incandescent (halogen, type of incandescent) for accent lighting and for applications where the light is usually off (exterior or motion sensor).

Energy Data Measurements:

Home Inventory	Standard Incandescent	Linear Fluorescent	Compact Fluorescent Light (CFLs)	Halogen	Average Wattage	Hours Used per day per bulb
Kitchen						
Living Room						
Family Room						
Dining Room						
Master Bedroom						
Other Bedroom (s)						
Bathroom (s)						
Hallway (s)						
Garage						
Outdoor (i.e. patio)						
Closets						
Utility / Other						
Totals						

Number of Replacement CFLs

CFL Size (Watts): _____	Cost per Bulb ($/bulb): _____
Number of Bulbs Replaced: _____	Total Cost of Bulbs: _____
CFL Size (Watts): _____	Cost per Bulb ($/bulb): _____
Number of Bulbs Replaced: _____	Total Cost of Bulbs: _____
CFL Size (Watts): _____	Cost per Bulb ($/bulb): _____
Number of Bulbs Replaced: _____	Total Cost of Bulbs: _____

Use the US DOE Energy Star CFLs calculator (See Part 2 – Energy Saving Calculator)

4. Solar Water Heater Systems

Manufacturer _____
Model Number _____
Serial Number _____
Year the Water Heater was installed: _____
Rated input (kBTU or kW) _____
Energy Factor _____
Recovery Efficiency (%) _____

Water Heater fuel: ☐ Electric ☐ Gas ☐ Propane

Water Heater Type:
☐ Conventional Tank system ☐ Demand (instantaneous) system
☐ Heat Pump system

Size/ Capacity of water heater:	Temperature Setting:
☐ Very Small (less than 30 gallons)	☐ Low (less than 120F)
☐ Small (30-49 gallons)	☐ Medium Low (between 120 and 130F)
☐ Medium (50-69 gallons)	☐ Medium (between 130 and 140F)
☐ Large (70-89 gallons)	☐ High (between 140 and 150F)
☐ Extra Large (90 gallons or more)	☐ Very High (higher than 150F)

Is there room to upgrade to an 80-gallon or 120 gallon or 200 gallon or 2 tanks?
☐ Yes ☐ No
If yes, which kind? _____

Do they have and use a Dishwasher?	☐ Yes	☐ No
Do they have and use a Clothes Washer ?	☐ Yes	☐ No
Is hot water consumed during normal working hours on weekdays?	☐ Yes	☐ No
Water Heater Wrapped?	☐ Yes	☐ No
If wrapped, kind of insulation:	☐ Fiberglass	☐ Polyurethane
Is there a timer?	☐ Yes	☐ No
Water Heater pipes insulated?	☐ Yes	☐ No

Additional Information for your files:
Replacement Water Heater
Manufacturer:
Model No.
Fuel: Gas, Propane, Electric, or Solar
Rated Input: (in kBTU or kW)
Capacity (in gallons):
Energy Factor:
Recovery Efficiency: %
Cost of New Solar Water Heater System: $_____
Installation Cost: $_____
Any Additional Cost: $_____

Use the Energy Guide calculator to estimate potential savings from a new water heater (See Part 2 – Energy Saving Calculator).

5. Refrigerator Replacements

Energy Data Measurements:
Manufacturer _____
Model Number _____
Serial Number_____
Year the refrigerator was installed: _____
Rated input (amp or kBTU or kW) _____
Overall Refrigerator Size (cu ft)_____
Original Cost of the Current Refrigerator:_____
Type of Fridge / Freezer model:
☐ Stand alone Fridge ☐ Stand alone Freezer ☐ Combination
Fridge Style: ☐ side by side ☐ bottom freezer ☐ top freezer ☐ single door
Door Seal Condition: ☐ Good ☐ Fair – Some Ware ☐ Poor – Visible Gaps

Frost-free Model	☐ Yes	☐ No
Through-door ice maker	☐ Yes	☐ No
Is this refrigerator rated by energy star?	☐ Yes	☐ No
Is there an additional stand-alone refrigerator?	☐ Yes	☐ No
Is there an additional stand-alone freezer?	☐ Yes	☐ No
If there is, what type is it?	☐ Upright	☐ chest

Additional Information for your files:

Replacement Refrigerator
Manufacturer:
Model:
Refrigerator Type:

1) Top Freezer
2) Bottom Freezer
3) Side-By-Side
4) Single door
5) Single door with freezer
6) Other

Defrost: Automatic, Manual, Partial Automatic or Other
Kwh Year:
Capacity: _____ cubic feet
Height (inches): Width (inches): Depth (inches):
Adjusted Consumption (kWh/yr):
Annual Savings (kWh/yr):
Cost of New Refrigerator: $_____
Installation Cost: $_____
Any Additional Cost: $_____

Calculate what you will save by replacing your old refrigerator with an energy-efficient model. See Part 2 – Energy Saving Calculators to use the Energy Saver Calculators from nergyguide.com and Life Cycle Cost Estimate for 1 Energy Star Qualified Residential Refrigerator(s).

6. Window Tint

Energy Data Measurements:

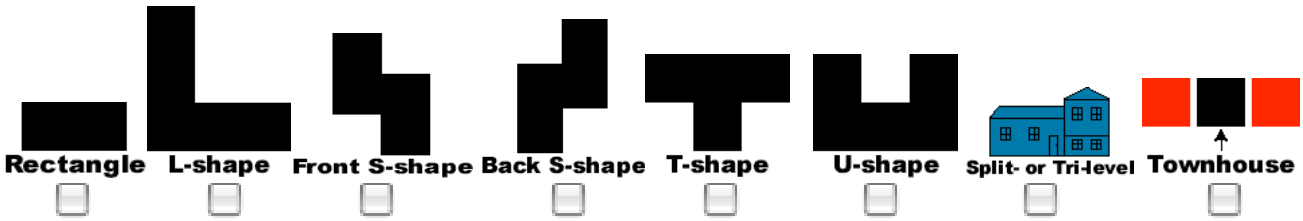
	Front	Left	Right	Back
Window area				
Movable window insulation R-values				

Movable window shades Interior Blinds Interior Drapes Exterior Blinds Exterior Drapes	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Is this side Shaded by something else?				
Number of windows on each side (assume each is about 12 sq ft in area)				
Window Sealings: Fairly leaky Average Fairly Tight Ultra Tight	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

Mark for each type used:

Glazing Type	Frame Type		
	Aluminum	Aluminum w/ Thermal Break	Wood or Vinyl
Single-pane, clear	☐		☐
Single-pane, tinted	☐		☐
Double-pane, clear	☐	☐	☐
Double-pane, tinted	☐	☐	☐
Double-pane, solar-control low-E	☐	☐	☐
Double-pane, solar-control low-E, argon gas fill			☐
Double-pane, insulating low-E			☐
Double-pane, insulating low-E, argon gas fill		☐	☐
Triple-pane, insulating low-E, argon gas fill			☐
Custom window	U-Factor_____ Solar heat gain coefficient_____		

The front of your house faces: ☐ North ☐ South ☐ East ☐ West
The interior floor-to-ceiling height in feet _____
Length of house (front to back) in feet _____
Width of house (left to right) in feet_____
The shape of your housing unit is closest to:



See Part 2 – Energy Saving Calculators for a sample map calculator from Panorama Window Films for Hawaii.

7. Room Air Conditioners

Energy Data Measurements:
How do you cool your home?
☐ Central or split units A/C ☐ Room A/C window units ☐ Other
Manufacturer _____
Model Number _____
Serial Number_____
Year the A/C unit was installed: _____
Rated input (kBTU) _____
SEER rating _____ or EER rating
_____
Initial cost of unit _____
Number of units _____
Cooled area(s) in sq ft _____
Number of hours on per day _____
Temperature setting on A/C for day_____
Temperature setting on A/C for night_____
Use with programmable Thermostat? ☐ Yes ☐ No

Additional Information for your files:

Duct System (if applicable)
Where are your ducts located in your home?
Are your ducts insulated? Yes, No, or Don't know.
Are your ducts sealed? Yes, No, or Don't know

Number of Ceiling Fans:

Replacement Room Air Conditioners
Manufacturer:
Model:
Capacity: (Btu/hr)
SEER: or EER:

Initial cost of unit (estimated cost per unit): $

See Part 2 – Energy Saving Calculators to calculate what you will save by replacing your old air conditioner with an energy-efficient model. Use either Energy Saver Calculators from energyguide.com or Life Cycle Cost Estimate for 1 Energy Star qualified Room Air Conditioner(s).

8. Residential Clothes Washers

Energy Data Measurements:
Manufacturer _____
Model Number _____
Serial Number_____
Year the clothes washer was installed: _____
Rated input (kBTU or kW) _____
Initial Cost _____
How many gallons used per wash_____
Style for Clothes Washer: ☐ Top loading ☐ Front Loading
Size: ☐ compact ☐ standard ☐ extra large
Number of Wash / Rinse cycles per temp:
_____Hot Wash / Warm Rinse _____Warm wash / Warm Rinse
_____ Warm Wash / Cold Rinse _____ Cold Wash / Cold Rinse
Energy Star Model: ☐ Yes ☐ No
Do you have and use a clothes dryer?
Manufacturer _____
Model Number _____
Serial Number _____
Year the clothes dryer was installed: _____
Loads dried per week _____
Style for Clothes Dryer: ☐ Top loading ☐ Front Loading
Dryer fuel: ☐ Electric ☐ Gas ☐ Propane
Energy Star Model: ☐ Yes ☐ No

Additional Information for your files:
Replacement Residential Clothes Washer
Equipment Type: Top Loading or Front Loading
Manufacturer:
Model:
Energy Star Model: Yes or No
Initial Cost of Unit (estimated cost per unit): $
Size: Compact, Standard or Large

See Part 2 – Energy Saving Calculators to calculate what you will save by replacing your old clothes washer with an energy-efficient model. Use either Energy Saver Calculators from energyguide.com or Life Cycle Cost Estimate for 1 Energy Star qualified clothes washer(s).

Part 2 – Energy Saving Calculators

Insert energy data measurements collected in part one, above, into the appropriate energy savings calculator. If national default values for electric and water rates are used instead of the current Hawaii rates, the energy savings calculated will generally be smaller. Using either rate, the energy saving calculators should show significant energy savings.
The energy data measurements with the calculated energy savings should assist the energy auditor to determine the proper weatherization measures to be installed.

1. Low-Flow Showerheads and Aerators

1) Determine the water savings of installing a new low-flow showerhead (in gpm)
Old showerhead: 2.5 gpm. New low-flow showerhead: 1.5 gpm. Savings: 1.0 gpm

2) Determine the number of persons in household: 2 adults and 2 teens = 4 persons

3) Active lifestyle of Hawaii results in 2 showers/day at 7 minutes for a total of 14 minutes/person.

4) Calculate amount of water saved: 1.0 gpm savings x 14 minutes x 4 persons/day x 365 days = 20,440 gals/yr

5) Calculate $ savings from water saved: $3/1000gals * 20,440 = $61.32

6) Calculate electricity saved: 20,440 gals x 500btu/gal (70 to 130F) / 3412 = 2,995.31 kWh

7) Calculate $ savings from electricity savings: 2,995.31* 0.2889 = $865.34

8) Total water and electrical savings: $61.32 + $865.34 = $926.66

Life cycle of showerhead*: 10 years
Estimated cost of showerhead*: $30
Installation cost of showerhead*: $15
*= see below for Assumptions

Assumptions
Assuming it takes 15 minutes to order, deliver and install showerhead as well as inform the homeowner at $60/hour, it will cost an additional $15. Cost of low-flow showerhead ranges from $8 - $50. Assume the cost is $30. People in Hawaii live an active lifestyle and due to the humid climate take 2-3 showers/daily, more than many other parts of the United States. Assuming a person takes 2 showers/day at 7 minutes for a total of 14 minutes/person. The life cycle for a low showerhead is about 10 years.

Low-Flow Showerhead SIR = $926.66 * 10 years life cycle / $45.00 = 205.92

Vary utility cost, hours of operation, and /or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to the default value).			Defaults	
Water Saving Product	Faucet		*Faucet*	*Showerhead*
Flow Rate		gpm	*2.2 gpm*	*2.5 gpm*
Water Cost (including waste water charges)		$/1000 gal	*$4/1000 gal*	*$4/1000 gal*
Gas Cost		$/therm	*0.60 $/therm*	*0.60 $/therm*
Electricity Cost		$/kWh	*0.06 $/kWh*	*0.06 $/kWh*
Minutes per Day of Operation		minutes	*30 minutes*	*20 minutes*
Days per Year of Operation		days	*260 days*	*365 days*
Quantity to be Purchased		unit(s)	*1 unit*	*1 unit*

Calculate Reset

OUTPUT SECTION

Performance per	**Your Choice**	**Base Model**	**FEMP Recommended Level**	**Best Available**	**Self Closing Faucet (gallon per cycle)**
WATER USE ONLY					
Gallon per Minute	gpm				
Annual Water Use	gal				
Annual Water Cost	$	$	$	$	$
Lifetime Water Cost	$	$	$	$	$
WITH ELECTRIC WATER HEATING					
Annual Energy Use	kWh				
Annual Energy Cost	$	$	$	$	$

Lifetime Energy Cost	$	$	$	$	$
Lifetime Energy and Water Cost Savings	$	$	$	$	$
Lifetime Energy and Water Cost Savings for	$	$	$	$	$

For electric water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and water cost savings (per) of $ over an estimated 10 year life expectancy compared to the base model.

For gas water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and water cost savings (per) of $ over an estimated 10 year life expectancy compared to the base model.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for faucets or showerheads.
- Lifetime energy cost and lifetime water cost is the sum of the discounted value of the annual energy and water costs based on an assumed faucet or showerhead life of 10 years.
- Future gas and electricity price trends and a discount rate of 3.2% are based on Federal guidelines.
- $0.06 per kWh is the Federal average electricity price in the U.S.
- $0.60 per therm is the Federal average gas price in the U.S.
- The assumed combined water and waste-water price is $4.00/1000 gallons.

Smart Energy Saving Power Strips

Entertainment

Please enter detail if you own the following appliances
Whenever there is more than one of a particular item, enter the average per-unit usage for all units in the house.
Do not select more than 24 hours in a day

Televisions

CRT Television (Cathode Ray Tube - Standard TV technology)	One	used	7	Hours	per	Day	Energy Star? Yes ○ No ●
CRT Projection Television	None	used	2	Hours	per	Day	

LCD Television: None used 2 Hours per Day

DLP Television: None used 2 Hours per Day

Plasma Television: None used 2 Hours per Day

Miscellaneous Video Equipment

DVD Player: One used 4 Hours per Week Energy Star? Yes No

VCR Player: One used 2 Hours per Week Energy Star? Yes No

Cable: One used 90 Minutes per Day (Hours used should indicate actual time spent viewing cable programs)

Satellite Dish: None used 0 per (Hours used should indicate actual time spent viewing Satellite programs)

Video Game: One used 1 Hours per Day

Audio Equipment

Audio Receiver / Tuner: One used 2 Hours per Week

Boombox - Portable CD/Radio/Tape: One used 30 Minutes per Week

CD Player: One used 30 Minutes per Week Energy Star? Yes No

Tape Player: One used 2 Hours per Week

Home Office

Please enter detail if you own the following appliances
Whenever there is more than one of a particular item, enter the average per-unit usage for all units in the house.
Do not select more than 24 hours in a day

Computer CPU: One used 5 Hours per Day

Computer Monitor: One used 5 Hours per Day

Laptop Computer Charger: None used 0 per (Time should indicate time that laptop is plugged into the charger)

Laser Printer: used 1 Hours per Week (Time should indicate time printer is actively printing)

Inkjet Printer: One used 1 Hours per Week (Time should indicate time printer is actively printing).

All inkjet printers naturally qualify as Energy Star, therefore there is no difference in the energy used by Energy Star vs. non-Energy Star inkjet printers.

Router / DSL / Cable Modem: One used 5 Hours per Day

Thermal Fax Machine: None used 4 Minutes per Day Energy Star? Yes No

Inkjet Fax Machine: None used 4 Minutes per Day

Home Copy Machine: None machine

Time Copying: 30 Minutes per Day

Time Left On but Idle: 0 Hours per Day

Miscellaneous Kitchen Equipment

Please enter detail if you own the following appliances
Whenever there is more than one of a particular item, enter the average per-unit usage for all units in the house.
Do not select more than 24 hours in a day

Bottled Water ==> Energy Star? Yes No
With heating or chilling ability

Instant Hot Water

Broiler: None used 1 Hours per Week (This is a "plug-in" broiler, not the unit built into your stove)

Coffee Machine - Drip: One Machine

Brew Cycle: 30 Minutes per Day

Warm: 1 Hours per Day

Coffee Machine - Percolator: None Machine

Brew Cycle: 30 Minutes per Day

Warm: 1 Hours per Day

Deep Fryer: None used Minutes per Week

Electric Fry Pan: None used Hours per Month

Espresso Machine: None used 1 Hours per Week

Microwave: One used Minutes per Day

Slow Cooker: None used Hours per Week

Toaster: One used 6 Minutes per Day

Toaster Oven: None Machine

Toasting 4 Minutes per Day

Oven Minutes per Day

Other Miscellaneous Equipment

Please enter detail if you own the following appliances
Whenever there is more than one of a particular item, enter the average per-unit usage for all units in the house.
Do not select more than 24 hours in a day

Home Care

Cordless Handheld Vacuum: None machines

Canister Vacuum Cleaner: None used 1 Hours per Week

Upright Vacuum Cleaner: One used 1 Hours per Week

Miscellaneous Electrical Uses

Aquariums: None used 24 Hours per Day (Set to 24 hours/day unless you specifically turn your aquarium filtration/pumps off)

Automobile Block Heater: None used 1 Hours per Day for 4 months in the year

Clock: Two machines

Dehumidifier: None used 24 Hours per Day Energy Star? Yes ○ No ●

Doorbell: Yes

Electric Blanket: None used 5 Hours per Day for 4 months in the year

Electric Grill: None used 1 Hours per Day for 4 months in the year

Electronic Air Cleaner: None used 24 Hours per Day Energy Star? Yes ○ No ●

Garage Door Opener: None used 8 Minutes per Day (Typical time to open or close the door is 3 minutes)

Hair Dryer: One used 7 Minutes per Day

Heat Tape: None used 1 Hours per Day for 4 months in the year

Humidifier: None used 24 Hours per Day

Iron: None used Minutes per Week

Pipe and Gutter Heaters: None used 2 Hours per Day for 4 months in the year

Waterbed Heaters: None machines

Piped Natural Gas Appliances

Gas Grill: None used 1 Hours per Day for 4 months in the year

Gas Lighting: None used 6 Hours per Week

Enter your Own: Electric Appliances

Item 1: None used per drawing 0 Watts

Item 2: None used per drawing 0 Watts

Item 3: None used per drawing 0 Watts

Gas Appliances

Item 1: None used per drawing 0 therms.

Item 2: None used per drawing 0 therms.

3. Compact Fluorescent Lights (CFLs)

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Compact Fluorescent Lamp(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors. CFLs are available in a variety of shapes and sizes, but pricing in this calculator is based on the most common spiral or globe with standard screw-in base.

Enter your own values in the gray boxes or use our default values.

Number of units	20
Electricity Rate ($/kWh)	$ 0.103
Hours used per day	3

	ENERGY STAR Qualified Unit	Conventional Unit
Initial cost per unit (estimated retail price)	$3.40	$0.60
Wattage (watts)	15 *	60
Lifetime (hours)	10,00	1,000

**ENERGY STAR wattage is calculated based on the wattage selected for the incandescent unit, user can enter an alternative value if desired.*

Annual and Life Cycle Costs and Savings for 20 CFLs

	20 ENERGY STAR Qualified Units	20 Conventional Units	Savings with ENERGY STAR
Annual Operating Costs*			
Energy cost	$34	$135	$102
Maintenance cost	$0	$79	$79
Total	$34	$214	$180
Life Cycle Costs*			
Operating cost (energy and maintenance)	$255	$1,612	$1,357
Energy costs (lifetime)	$255	$1,019	$764
Maintenance costs (lifetime)	$0	$593	$593
Purchase price for 20 unit(s)	$68.00	$12.00	-$56.00
Total	$323	$1,624	$1,301
Simple payback of initial additional cost (years)†			0.3

* *Annual costs exclude the initial purchase price. All costs, except initial cost, are discounted over the products' lifetime using a real discount rate of 4%. See "Assumptions" to change factors including the discount rate.*

† *A simple payback period of zero years means that the payback is immediate.*

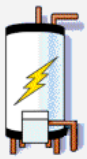
Summary of Benefits for 20 CFLs

Initial cost difference	$56
Life cycle savings	$1,357
Net life cycle savings (life cycle savings - additional cost)	$1,301
Simple payback of additional cost (years)	0.3
Life cycle energy saved (kWh)	9,000
Life cycle air pollution reduction (lbs of CO_2)	13,860
Air pollution reduction equivalence (number of cars removed from the road for a year)	1.15
Air pollution reduction equivalence (acres of forest)	1.43
Savings as a percent of retail price	1914%

4. Water Heater Systems

Water Heater Calc

This calculator estimates how much it will cost to purchase and operate a new water heater. It will also tell you how much you might save on energy bills compared to your old water heater. Please enter your ZIP Code and choose an answer for each of the water heater questions listed. Then click "Calculate" to see your results. If you need help, click on the question.



Please answer the following questions about your water heater.

Your ZIP Code:	96815
Water heater fuel:	○ Electricity ◉ Gas ○ Oil ○ Propane
Water heater type:	◉ Conventional tank system ○ Demand (instantaneous) system ○ Heat pump water heater
Age:	5-9 years
Size:	○ Very small: 30 gallons or less ◉ Small: 30-49 gallons ○ Medium: 50-69 gallons ○ Large: 70-89 gallons ○ Very large: 90 gallons or more
Temperature Setting:	Medium high: 130-140 degrees

The following questions will help us estimate how much hot water you use.

How many people live in your home?	3

Do you have any of the following appliances in your home?

Dishwasher	○ Yes	◉ No
Clothes Washer	○ Yes	◉ No

Calculate

Water Heater Calc

Replace your old water heater with a new, energy-efficient model and you could save up to $600 over the life of the new water heater. See the detailed savings estimate below.

Savings and Cost Information if you switched to an energy-efficient Gas Conventional Tank Water Heater

Savings	
Annual Dollars	$35-$58
Lifetime Dollars	$400-$600
Gas (therms)	11-19 therms/yr
CO_2	140-220 lbs/yr
Cost	
Est. Installed Cost	$500-$800
Annual Energy Cost	$500-$700

Choose options for replacement.

Fuel: Gas

Type: Conventional Tank

Click to update savings.

Update Savings

Savings Tips Learn more about cost saving Hot Water Heater tips

How to Use this Spreadsheet to Evaluate Water Heater Replacement

1. Average Daily Hot Water Use. Select the *Hot Water Consumption* sheet. Enter the number of **Occupants** that live in the housing unit throughout the entire year. Enter either "Y" (Yes) or "N" (No) for **Dishwasher Present** and **Clothes Washer Present**.
2. Determine your replacement strategy and select the appropriate worksheet.
   A. Tank-to-Tank estimates cost-effectiveness of replacing a conventional tank water heater with another tank water heater.
   B. Tank-to-Tankless estimates cost-effectiveness of replacing a conventional tank water heater with a tankless (demand or instantaneous) water heater.
   C. Tank-to-HP estimates cost-effectiveness of replacing a conventional tank water heater with an electric heat pump water heater.
   D. Tank-to-Solar estimates cost-effectiveness of replacing a conventional tank water heater with a solar hot water system.

Enter the specifications of the existing water heater in the "Existing" column. Enter the specifications of the candidate water heater in the "Replacement" column to determine if the new water heater is cost effective. **Blue and bolded specifications are required.** *Italics indicate sheets.*

The green sections on each sheet contain the input to determine if replacement is cost effective.
The blue sections on each sheet show the results of the replacement analysis.

A. *Tank-to-Tank* and *Tank-to-Tankless*

Water Usage: The average daily water use from the *Hot Water Use* sheet is automatically entered.
Fuel Type: Select the water heating fuel.
EF: Enter the Energy Factor from the GAMA directory, *Table 4*, or *Table 5*. See *Appendix D* for determining the year of manufacture needed to use *Table 5*.
RE: Enter the Recovery Efficiency from the nameplate, GAMA directory, or *Table 6*.
Power: Enter the burner capacity from the nameplate, GAMA directory, or *Table 7*.
Equipment Lifetime: Enter the anticipated equipment lifetime for the water heater. The warranty of the water heater is a good indicator of the lifetime.
Installed Cost: Enter the equipment and installation costs needed to determine if replacement is cost effective.
State: Select your state. Default fuel prices and ground water temperatures used to estimate energy savings use these values.

Tank Location: Results are shown depending upon the location of the new and replaced water heaters.
Energy Savings: Similar to results from NEAT, the annual energy savings are listed.
Maximum Allowable Investment at Savings-to-Investment Ratio (SIR) of 1.0: The maximum cost for a cost-effective water heater based on the Energy Savings.
SIR at Installed Cost: The energy savings over the life of the replacement water heater, discounted to present value, divided by the installed cost. SIRs greater than or equal to one are cost effective. If the SIR is less than one, the replacement is not cost effective.

B. *Tank-to-HP*

The data entry is much the same as for Tank-to-Tank and Tank-to-Tankless replacement. Since a heat pump water heater draws heat from ambient air to heat water, information about the space heating and cooling systems is needed to assess the energy gains and/or penalties. Space heating energy gains and losses are included when the water heater is located with conditioned space. Unintentionally conditioned spaces include the energy penalty during the heating seasons, but not the cooling benefit.

Space Heating: Select the main space heating fuel type used by the space heating equipment. Select the type of main space heating equipment for the household.
Space Cooling: Select the main space cooling fuel. Select the type of main space cooling equipment for the household.

C. *Tank-to-Solar*

EF/SEF: Enter the Energy Factor of the tank water heater. Enter the Solar Energy Factor of the solar water heater system.
Solar Water Heater System Cost: Enter the equipment and installation costs of the solar water heater system.
Solar Water Heater Collector Lifetime: Enter the collector lifetime; typically the warranty period is a good indication.

Tank Replacement Cost: The solar water heating system (collectors, controls, etc.) will outlive the tank water heater that is also a required part of the system. Therefore, the tank water heater will need to be replaced at some point within the economic lifetime of the solar system. Enter the cost (in today's dollars) to replace the tank water heater when the original tank fails.
Tank Replacement Lifetime: Enter the lifetime or warranty period of the tank water heater that is part of the solar water heating system. This lifetime is also used for any additional tank water heaters needed throughout the life of the solar water heating system.

Occupants	**3**	[# of occupants]
Dishwasher Present	**N**	[Y/N]
Clothes Washer Present	**Y**	[Y/N]
AVERAGE DAILY WATER USAGE	**45.4**	[gallons per day]

	Existing	Replacement
Water Usage [gallons/day]	45.4	45.4
Fuel Type	Natural Gas	Natural Gas
EF	0.50	0.62
RE	0.66	0.76
Power [Btu/h]	40,000	40,000
Fuel Price [$/MMBtu]	12.24	12.24
Equipment Lifetime [yrs]		10
Installed Cost		$ 750
State	Alabama	
Groundwater Temperature [F]	69	

Tank Location	Energy Savings [$/yr]	Maximum Allowable Investment at SIR of 1	SIR at Installed Cost
Outside: Ambient temps	$ 50	$ 423	0.6
Conditioned space	$ 44	$ 374	0.5
Unintentionally conditioned space	$ 44	$ 374	0.5
Unconditioned space	$ 46	$ 387	0.5

	Existing	Replacement
Water usage [gallons/day]	45.4	45.4
Fuel Type	Natural Gas	Natural Gas
EF	0.50	0.80
RE	0.68	0.82
Power [Btu/h]	40,000	165,000
Fuel Price [$/MMBtu]	12.24	12.24
Equipment Lifetime [yrs]		15
Installed Cost		$ 1,250
State	Alabama	
Groundwater Temperature [F]	69	

Tank Location	Energy Savings [$/yr]	Maximum Allowable Investment at SIR of 1	SIR at Installed Cost
Outside: Ambient temps	$ 113	$ 1,318	1.1
Conditioned space	$ 88	$ 1,026	0.8
Unintentionally conditioned space	$ 88	$ 1,026	0.8
Unconditioned space	$ 102	$ 1,195	1.0

	Existing	Replacement		
EF	0.45	2.37		
RE	0.68		Space Heating	
Fuel Type	Natural Gas	Electric	Fuel	Natural Gas
Water Usage [gallons/day]	45.42	45.42	System	Furnace
Power [Btu/h]	40,000		Space Cooling	
Fuel Price [$/MMBtu]	12.24	22.33	Fuel	Electricity
Equipment Lifetime [yrs]		10	System	Room AC
Installed Cost		$ 1,250		
State	Alabama			
Groundwater Temperature [F]	69			

Tank Location	Energy Savings [$/yr]	Maximum Allowable Investment at SIR of 1	SIR at Installed Cost
Outside: Ambient temps	$ 178	$ 1,499	1.2
Conditioned space	$ 134	$ 1,127	0.9
Unintentionally conditioned space	$ 108	$ 904	0.7
Unconditioned space	$ 166	$ 1,394	1.1

	Existing	Replacement
EF/SEF	0.86	2.20
RE	0.98	
Fuel Type	Electricity	Electricity
Water Usage [gallons/day]	45.4	45.4
Power [Btu/h]	15,354	
Fuel Price [$/MMBtu]	52.93	52.93
Solar Water Heater System Cost		$2,000
Solar Water Heater Collector Lifetime		20
Tank Replacement Cost		$400
Tank Replacement Lifetime		10
State	Hawaii	
Groundwater Temperature [F]	77	

Tank Location	Energy Savings [$/yr]	Maximum Allowable Investment at SIR of 1	SIR at Installed Cost
Outside: Ambient temps	$ 294	$ 4,260	1.86
Conditioned space	$ 287	$ 4,159	1.82
Unintentionally conditioned space	$ 287	$ 4,159	1.82
Unconditioned space	$ 277	$ 4,008	1.75

Table 4 – Minimum Energy Factors Required by NAECA* for Post-1990 Water Heaters

Fuel Type	Tank Size [Gallons]			
	30	40	50	75
Natural Gas Or	0.56	0.54	0.53	0.48
Electric	0.89	0.88	0.86	0.83
Oil	0.53	0.51	0.5	0.45

* National Appliance Energy Consumption Act of 1987

Table 5 – Pre-1990 Water Heater Energy Factors

Fuel Source	<1982	1982-1984	1985	1986-1987	1988-1989
Electric	0.80	0.81	0.82	0.82	0.83
Natural Gas	0.48	0.48	0.48	0.49	0.49

Source: Wenzel, Tom P., Jonathan G. Koomey, Gregory J. Rosenquist, Marla Sanchez, and James W. Hanford 1997. Energy Data Sourcebook for the U.S. Residential Sector. Lawrence Berkeley National Laboratory (LBL-40297).

Table 6 – Typical Water Heater Recovery Efficiencies	
Fuel Source	**Recovery Efficiency (RE)**
Electric	98%
Natural Gas or Propane	76%
Oil	76%
Source: Wenzel, Tom P., Jonathan G. Koomey, Gregory J. Rosenquist, Marla Sanchez, and James W. Hanford 1997. Energy Data Sourcebook for the U.S. Residential Sector. Lawrence Berkeley National Laboratory (LBL-40297).	

Table 7 – Typical Water Heater Input Power Ratings	
Fuel Type	**Burner/Element Input (P_{on})**
Natural Gas or Propane	40,000 Btu/h
Electric Resistance	4.5 kW
Oil	95,000 Btu/h

5. Refrigerator Replacements

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Residential Refrigerator(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of units	20
Electricity Rate ($/kWh)	$ 0.113
Choose the type of refrigerator	1-Manual Defrost Refrigerators

	ENERGY STAR Qualified Unit	Conventional Unit
Initial cost per unit (estimated retail price)	$1,180	$1,150
Refrigerator Fresh Volume (ft^3)	14.75	14.75
Refrigerator Freezer Volume (ft^3)	6.76	6.76
Refrigerator Total Volume (ft^3)	21.51	21.51

Annual and Life Cycle Costs and Savings for 20 Residential Refrigerator(s)

	20 ENERGY STAR Qualified Unit(s)	20 Conventional Unit(s)	Savings with ENERGY STAR
Annual Operating Costs*			
Energy costs	$858	$1,072	$214
Total	$858	$1,072	$214
Life Cycle Costs*			
Energy costs	$8,050	$10,063	$2,013
Energy consumption (kWh)	*91,331*	*114,163*	*22,833*
Purchase Price for 20 unit(s)	$23,600	$23,000	-$600
Total	$31,650	$33,063	$1,413
Simple payback of initial additional cost (years)†			2.8

* *Annual costs exclude the initial purchase price. All costs, except initial cost, are discounted over the products' lifetime using a real discount rate*

† *A simple payback period of zero years means that the payback is immediate.*

Summary of Benefits for 20 Residential Refrigerator(s)

Initial cost difference	$600
Life cycle savings	$2,013
Net life cycle savings (life cycle savings - additional cost)	$1,413
Simple payback of additional cost (years)	2.8
Life cycle energy saved (kWh)	22,833
Life cycle air pollution reduction (lbs of CO_2)	35,162
Air pollution reduction equivalence (number of cars removed from the road for a year)	2.92
Air pollution reduction equivalence (acres of forest)	3.62
Savings as a percent of retail price	6%

Fridge Calc

FridgeCalc estimates what you will save by replacing your old refrigerator with a new, energy-efficient model. Please enter your ZIP code and choose an option for each of the refrigerator features listed. Then click "Calculate" to continue.

Your ZIP Code:	96815				
Style:	○ Side-by-side ○ Bottom freezer	● Top freezer ○ Single door			
Age:	5-9 years				
Size:	○ Very large (over 24 cubic feet)	○ Large (22 to 24 cubic feet)	● Average (17 to 21 cubic feet)	○ Small (13 to 16 cubic feet)	○ Portable (less than 13 cubic feet)
Frost-free model:	● Yes	○ No			
Through-door ice maker:	○ Yes	● No			
ENERGY STAR® Model:	○ Yes	● No			

Calculate

Fridge Calc

Replace your old refrigerator with a new, energy-efficient model and you could save up to $900 over the life of the new machine. See the detailed savings estimate below.

Savings and Cost Information if you switched to an energy-efficient 17-21 cf Top Freezer Refrigerator

Savings	
Annual Dollars	$28-$46
Lifetime Dollars	$600-$900
kWh	160-260 kWh/yr
CO_2	260-430 lbs/yr
Cost	
Est. Purchase Price	$500-$800
Annual Energy Cost	$80-$100

Choose Options for replacement.

Style: Top Freezer

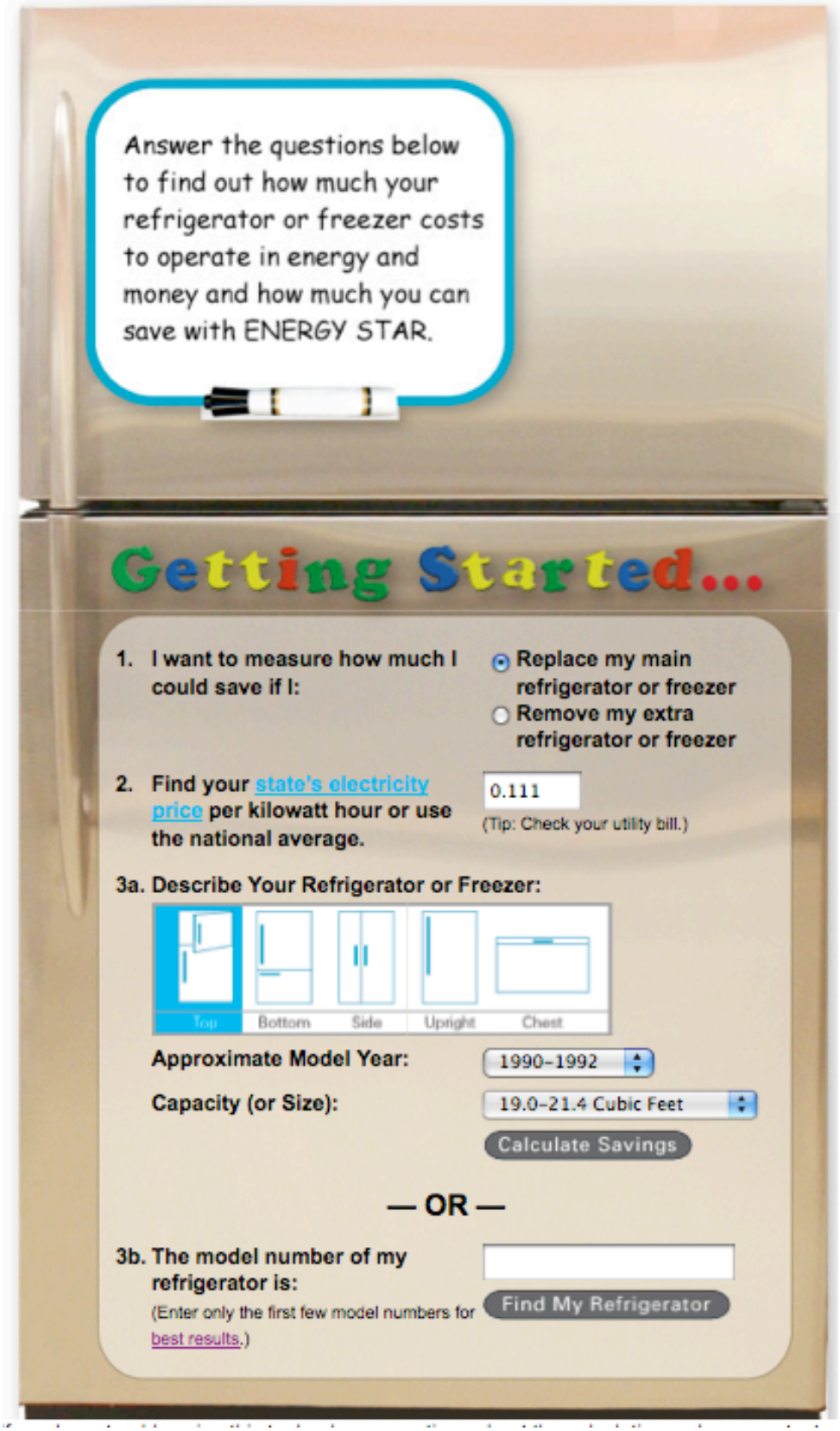
Size: Average (17 - 21 cubic feet)

Update refrigerator savings.

Update Savings

Savings Tips — Learn more about cost saving refrigerator tips

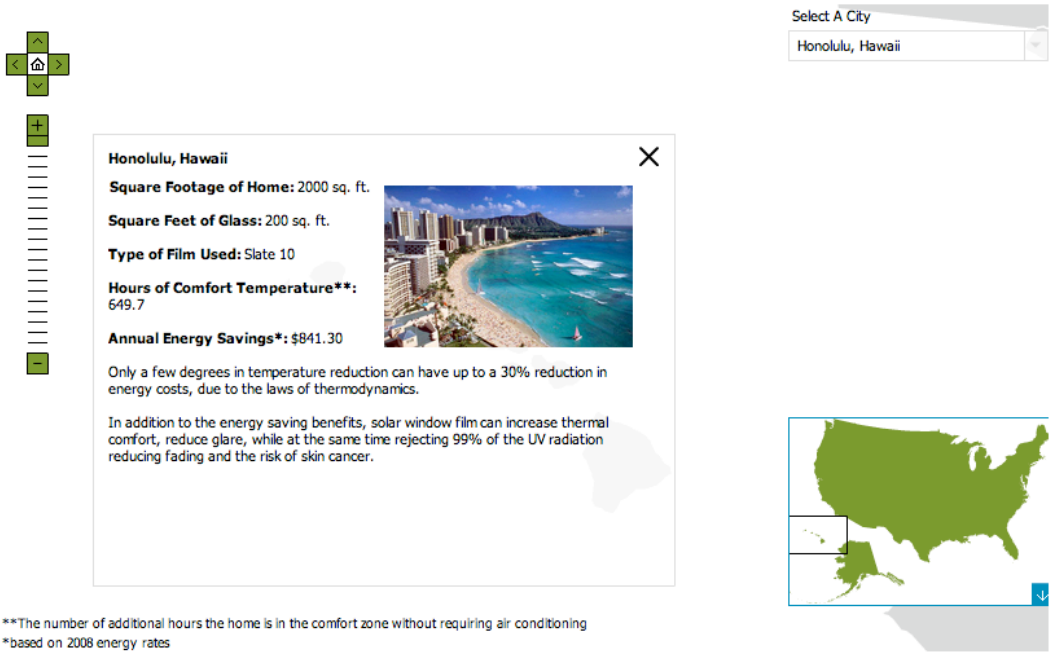
Refrigerator Retirement Savings Calculator



6. Window Tint

U.S. Residential Energy Savings Map

By installing Panorama window Films, you can save energy, which can mean saving money on your electricity. At the same time, Panorama window film will increase the number of hours your home is comfortable without airconditioning. Click on a U.S. city or make a selection from the drop down menu to view potential savings. For a free Residential Energy Analysis, use our dealer locator and select a Panorama PremierPlus dealer near you.



**The number of additional hours the home is in the comfort zone without requiring air conditioning
*based on 2008 energy rates

Energy savings calculated using Panorama Specularis using a standard home size of 2,000 square feet with 200 square feet of windows. Calculations are made using historical weather data for the local climate zone per city. This estimate is not meant to be representative of the measurements or conditions of any other zone in or actual conditions of the home. Actual weather patterns and data may vary significantly from year to year. Therefore, the data presented in this report is only an estimate of typical average savings for a building located within the local climate zone. This is an estimate only and does not purport to contain facts or figures regarding actual cost savings or actual temperature reductions since actual results may vary.

7. Room Air Conditioner

Room AC Calc

Estimates the size of the room air conditioner needed for your home and prepares a cost estimate for a new unit. Answer the following questions then click on Calculate to see the results for your home.

Length of room in feet	10		
Width of room in feet	10		
Is the room very sunny or very shady during the time you normally run the air conditioner?	○ Sunny	○ Shady	○ Neither
Is the room a kitchen?	○ Yes	○ No	
How many people normally occupy the room?	2 or less		

Calculate Reset

Results

- The size room AC unit you need is:
- The estimated cost for an ENERGY STAR® model:

Fridge Calc

Replace your old refrigerator with a new, energy-efficient model and you could save up to $900 over the life of the new machine. See the detailed savings estimate below.

Savings and Cost Information if you switched to an energy-efficient 17-21 cf Top Freezer Refrigerator

Savings

Annual Dollars	$28-$46
Lifetime Dollars	$600-$900
kWh	160-260 kWh/yr
CO_2	260-430 lbs/yr

Cost

Est. Purchase Price	$500-$800
Annual Energy Cost	$80-$100

Choose Options for replacement.

Style: Top Freezer

Size: Average (17 - 21 cubic feet)

Update refrigerator savings.

Update Savings

Savings Tips — Learn more about cost saving refrigerator tips

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Room Air Conditioner(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of units	20
Electricity Rate ($/kWh)	$0.103
Choose your city from the menu at right	DC-Washington

	ENERGY STAR Qualified Unit	Conventional Unit
Initial Cost per Unit (estimated retail price)	$220	$170
Energy Efficiency Ratio (EER)	10.8	9.8
Cooling Capacity of Air Conditioner (Btu/hr)	10,000	10,000

Annual and Life Cycle Costs and Savings for 20 Room Air Conditioner(s)

	20 ENERGY STAR Qualified Unit(s)	20 Conventional Unit(s)	Savings with ENERGY STAR
Annual Operating Costs*			
Energy cost	$2,518	$2,775	$257
Energy consumption (kWh)	*24,444*	*26,939*	*2,494*
Maintenance cost	$0	$0	$0
Total	$2,518	$2,775	$257
Life Cycle Costs*			
Operating costs (energy and maintenance)	$18,721	$20,631	$1,910
Energy costs	$18,721	$20,631	$1,910
Energy consumption (kWh)	*220,000*	*242,449*	*22,449*
Maintenance costs	$0	$0	$0
Purchase price for 20 unit(s)	$4,400	$3,400	-$1,000
Total	$23,121	$24,031	$910
Simple payback of initial additional cost (years)†			3.9

* *Annual costs exclude the initial purchase price. All costs, except initial cost, are discounted over the products' lifetime using a real discount rate of 4%. See "Assumptions" to change factors including the discount rate.*

† *A simple payback period of zero years means that the payback is immediate.*

Summary of Benefits for 20 Room Air Conditioner(s)

Initial cost difference	$1,000
Life cycle savings	$1,910
Net life cycle savings (life cycle savings - additional cost)	$910
Simple payback of additional cost (years)	3.9
Life cycle energy saved (kWh)	22,449
Life cycle air pollution reduction (lbs of CO_2)	34,571
Air pollution reduction equivalence (number of cars removed from the road for a year)	3
Air pollution reduction equivalence (acres of forest)	4
Savings as a percent of retail price	21%

8. Residential Clothes Washers

Washer Calc

This calculator estimates the costs, energy, and water you will save by replacing your old clothes washer.

Please enter your ZIP code and choose an option for each of the clothes washer features listed. Then click "Calculate" to continue.

Your ZIP Code:	96815			
Style of Clothes Washer:	(•) Top loading	( ) Front loading		
Age:	10-15 years			
Size:	(•) Standard	( ) Compact	( ) Extra large	
Loads washed per week:	7-11			
Wash cycle temperature:	( ) Hot	(•) Warm	( ) Cold	
Rinse cycle temperature:	( ) Hot	( ) Warm	(•) Cold	
Water heater fuel:	( ) Electric	(•) Gas	( ) Oil	( ) Propane
ENERGY STAR® Model:	( ) Yes	(•) No		

Calculate

Washer Calc

Replace your old washing machine with a new, energy-efficient model and you could save up to $1,300 over the life of the new machine. See the detailed savings estimate below.

Savings and Cost Information if you switched to an energy-efficient Standard Top Loading Clothes Washer

Savings	
Annual Dollars	$60-$100
Lifetime Dollars	$800-$1,300
kWh	- kWh/yr
Water (Gallons)	5,900-9,900 Gallons/yr
Gas (therms)	17-28 therms/yr
CO_2	200-330 lbs/yr
Cost	
Est. Purchase Price	$500-$900
Annual Energy Cost	$100-$120
Annual Water Cost	$14-$18

Choose Options for replacement.

Style: Top Loading

Size: Standard

Update Clothes Washer Savings

Update Savings

Savings Tips — Learn more about cost saving Clothes Washer tips

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Residential Clothes Washer(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Choose the type of washing machine	Residential
Number of units	20
Electric Rate ($/kWh)	$0.113
Water Rate ($/1000 gallons)	$4.529
Gas Rate ($/therms)	$1.330
Average Number of Loads per Week	7.5
Type of Water Heating	Gas Water Heating

	ENERGY STAR Qualified Unit	Conventional Unit
Initial Cost per Unit (estimated retail price)	$702	$573

Annual and Life Cycle Costs and Savings for 20 Residential Clothes Washer(s)

	20 ENERGY STAR Qualified Unit(s)	20 Conventional Unit(s)	Savings with ENERGY STAR
Annual Operating Costs*			
Electricity costs	128.25	181.90	53.65
Electricity consumption (kWh)	*1138.00*	*1614.00*	*476.00*
Water costs	528.44	1148.46	620.02
Water consumption (gal)	*116680.00*	*253580.00*	*136900.00*
Gas costs	611.80	864.50	252.70
Maintenance costs	0.00	0.00	0.00
Total	$1,268	$2,195	$926
Life Cycle Costs*			
Operating costs (electricity, water, and maintenance)	11112.63	19228.03	8115.40
Electricity costs	1123.55	1593.51	469.96
Water costs	4629.42	10061.09	5431.67
Gas costs	5359.66	7573.43	2213.77
Maintenance costs	0.00	0.00	0.00
Purchase price for 20 unit(s)	14040.00	11460.00	-2580.00
Total	25152.63	30688.03	5535.40
Simple payback of initial additional cost (years)†			2.8

* *Annual costs exclude the initial purchase price. All costs, except initial cost, are discounted over the products' lifetime using a real discount rate of 4%. See "Assumptions" to change factors including the discount rate.*

† *A simple payback period of zero years means that the payback is immediate.*

Summary of Benefits for 20 Residential Clothes Washer(s)

Initial cost difference	-$2,580.00
Life cycle savings	$8,115.40
Net life cycle savings (life cycle savings - additional cost)	$5,535.40
Simple payback of additional cost (years)	2.79
Life cycle electricity saved (kWh)	5236.00
Life cycle air pollution reduction (lbs of CO_2)	8063.44
Air pollution reduction equivalence (number of cars removed from the road for a year)	0.67
Air pollution reduction equivalence (acres of forest)	0.83
Savings as a percent of retail price	39%

Part 3 – Weatherization Measure Checklists

The following checklists provide tips to assist auditors and clients to further maximize and maintain energy savings. Regardless of the auditor's energy savings implementations, these checklists should be used as recommended guidelines. The energy auditor / educator should go through the following checklists and make recommendations based on a case-by-case basis. They should also determine whether he or she can or is able to make the renovations or if a specialist or other arrangements are needed. The primary responsibility falls on the auditor to enforce these recommendations, but the client may take an active role in any auditor-approved changes.

1. Low-Flow Showerheads and Aerators Checklist

- **Mineral buildup can result in less flow than rated**. In areas with hard water, consider purchasing showerheads that can be taken apart and cleaned.
- **Do not use flow restrictor inserts.** Restrictors are orifices designed to reduce water consumption. Restrictors are usually designed as a plastic insert installed inside the showerhead connectors, but they typically do not stifle enough water pressure to reduce water use.
- **Install user-friendly shower valves.** If the valve in the shower provides only full flow, the bather must adjust the spray at the showerhead to modulate flow. Having the option to modulate flows could reduce water usable and therefore the energy needed to heat it.
- **Avoid On-Off Valves**. In principle, this valve avoids the need to adjust the main hot and coldwater valves. Once the main valves are set properly, the water is simply turned off at the showerhead. In reality, it does not speed the process of getting the desired water temperature in the shower. The stagnant water must still clear the line quickly. This type of showerhead is also prone to causing leaky valves.
- **Conduct general maintenance.** Non-adjustable high-efficiency showerheads have tiny orifices that trap particles behind the nozzle plate. With enough accumulation, the particles can clog the entire unit. Unscrew the unit and empty the grit.

Other lifestyle choices that will help save water while bathing:

- Take shorter showers instead of baths or shower less often.
- Don't run the water full force when showering.
- Turn the shower off while soaping or shaving.
- Keep the water shallow when using the tub.

Faucets Checklist

- **Install a faucet aerator.** Many local utility companies give away low-flow aerators free so call first before buying.
- **Conduct general maintenance.** Clean faucet aerators to loosen mineral deposits. Fix leaky faucets immediately and also check pipes for leaks.
- **Leading brands offer similar performance.** In 2003, Consumer Reports found little variation in the performance of single and dual-handle faucets.
- **Select a preference for single-handle or dual-handle types.** Single-handle faucets are easiest to install although dual-handle models allow users to monitor water temperatures

more easily. If you're replacing a faucet, purchase single-or dual-handle type depending on what you are currently using. Using the current set-up allows for easier installation.

- **Avoid selecting chrome fixtures due to potential health concerns.** According to the Environmental Protection Agency (EPA), chromium may cause skin irritation, ulcerations, or even damage to skin and organs.

2. Smart Energy Saving Power Strips Checklist

SAVE ENERGY WITH PRODUCTS YOU ALREADY OWN

- Unplug mobile phone or PDA chargers when batteries are fully charged or when not in use.
- Be power-wise with your PC. Most personal computers have management features that control energy use.
- When finished, don't forget to turn off your DVD player or video game console as well as the television itself.
- **Home Entertainment Equipment.** Plug electronics, such as TVs, DVD players and audio systems, into power strips. Turn the power strips off when the equipment is not in use. Just be sure to read the manual first to make sure you won't affect the product. An ENERGY STAR TV means that unit saves energy both in standby and active modes. ENERGY STAR qualified TVs use about 30% less energy than standard units. A Set-top box is a cable, satellite, Internet Protocol or other device whose primary function is to receive television signals from a specific source and deliver them to a consumer display and or recording device, such as a television. Set-top boxes that have earned the ENERGY STAR are at least 30 percent more efficient than conventional models. When off, ENERGY STAR qualified DVD products use as little as one quarter of the energy used by standard models. They consume less than or equal to 1 Watt in standby mode. ENERGY STAR qualified audio products use about 6% less energy than standard models. Home audio products should also consume less than or equal to 1 Watt in standby mode.
- Save fuel by shopping and banking from home on your computer.

PLAN GREEN WHEN PURCHASING

- **Home Office Equipment.** Using ENERGY STAR qualified office equipment that meets the new specification (e.g., computer, monitor, printer, and fax machine) in your home office can save you $115 over the life of the products and more if you don't have ENERGY STAR office products. ENERGY STAR qualified computer monitors/displays use from 25–60% less electricity than standard models, depending on how they are used. In off mode, computer monitor models must consume 1 watt or less. Cordless phones, answering machines, and combination units that have earned the ENERGY STAR perform much more efficiently than conventional units and use about one-third of the energy. These products use less energy by incorporating improved energy performance features such as switch-mode power supplies and "smart" chargers. Investigate home-networking and

automation products and services that let you control heating, lighting, and cooling from a central location in the home or while you are away.

- When in the market for home office products, consider a multifunction device, which combines printing, copying, scanning and faxing. Extra tip: print double sided and only when necessary!

MAKE YOUR PRODUCTS LAST

- Review you owner's manuals for cleaning and maintenance of all products.
- Take care of your products' insides. Never block or cover the ventilation areas of your electronics—these holes keep the product from overheating, which could shorten its life. Also, never stack components atop one another.
- Keep electronics out of direct sunlight and away from heaters and radiators. Likewise, keep out of areas with high humidity or dust.
- Never use a vacuum to clean dust from electronics. This can create static and harm your components.
- Dust your components with a damp, lint-free cloth and a mild, heavily diluted cleaning agent or specialty anti-static wipes. Be careful with solvents as they can damage television and PDA screens.
- Never spray water or cleaners directly onto electronics.
- If you spill liquid on your electronics, stop using it immediately, unplug it and seek customer service.
- LCD (liquid crystal displays) and plasma screens are extremely delicate. Never use glass cleaner or detergents. Electronics retailers sell special cleaners for these screens. Also, do not apply pressure when cleaning wiping and be sure the television or monitor has cooled.
- LCD and plasma screens should never be stored in enclosed cases, as they are prone to overheating.

3. Compact Fluorescent Lights (CFLs) Checklist

Electric Lighting Checklist

- CFLs used in the three high-use home locations (including kitchen and entry light).
- CFLs substituted for incandescent lights.
- Dimmers for spaces where low-level lighting appropriate. A few of the newer CFLs can use typical dimmers. Most CFLs cannot operate properly with dimmers, and can cause a fire.
- Use “full-size” fluorescent lamp fixtures for best efficiency and color rendering.
- Fluorescent lamps (T-8 or T-5 instead of T12) used in service area of the home (Bulbs with CRI > 80 and CCT of 3000K).
- Electronic ballasts for all fluorescents installed.
- Reflectors in can fixtures to maximize available light.
- Light tubes installed to reduce need for electric lighting.
- Use timers, occupancy sensors and/or photo sensors.
- Use sparingly high quality low-voltage halogen bulbs.
- Replace halogen “torchiere” floor lamps with CFL floor lamps.
- White colored ceilings and walls as well as mirrors increase light levels.

- Turn off lights and keep lights off during the day especially when not in use.
- Keep fixtures and bulbs clean. Dirt, along with being unsightly, can absorb as much as 50% of the light.

Day lighting - Skylights
The challenge to using daylight in Hawaii residences is to get enough light into the desired area without too much heat. Clear prismatic or white diffuse skylights provide a pleasant alternative, making a room feel bright and airy. A shallow well minimizes light loss, while higher ceilings and sloped walls of the skylight improve light distribution. Here in Hawaii, vented skylights should be placed on the leeward downwind side of the roof for best performance.
Does your home have skylights? Yes or no.

4. Solar Water Heater Systems Checklist

Water Heating Checklist
- Electric water heater upgrade with minimal EF of 0.93.
- Water heater timer installed.
- Set the thermostat for 120^{o}F or less.
- Gas water heater upgrade with minimal EF of 0.60.
- Heat trap installed or 1-inch pipe insulation on at least the first 8 feet of outlet pipe from water heater.
- Insulate hot water pipes with at least 0.5 inches foam or 1.0 inch of fiberglass insulation.
- Water heater located within 20 feet pipe length of bathroom fixtures.
- Use a heat pump water heater with minimum 1.9 EF.
- Solar heater or heat pump for swimming pool heaters.
- Plan for solar water heating in the future by providing hot water pipe stubs. Design south-facing roof area for future solar collector (minimum 80 square feet within 30 degrees of true south).
- Solar water heater installed.
- Install water-conserving fixtures like low-flow showerheads and aerators in faucets.
- Fix drippy faucets.
- Don't let the water run.
- Consider horizontal-axis (front-loading) washing machines that use much less water.

5. Refrigerator Replacements Checklist

Refrigerator Checklist
- Compare Energy Guide labels for savings.
- Buy the optimal size – 18 to 21 cubic feet for 4 to 5 occupants.
- Select top or bottom freezer rather than side-by-side.
- Avoid models with icemakers and through-the-door water dispensers.
- Should have separate freezer and refrigerator compartment controls.
- Set temperatures at 36-38^{o}F in refrigerator and 0-5^{o}F in freezer.
- Place refrigerator away from heat sources such as stoves and ranges.
- Provide 3 inches of air space around coils for them to operate efficiently.
- Keep the refrigerator level so that the door closes properly.

- Keep refrigerator foods covered. Your refrigerator needs to work harder if the air inside is humid.
- Reduce the load. Refrigerators operate most efficiently when full but not overloaded.
- Don't put hot food in the refrigerator. Allow leftovers to cool before putting in the refrigerator.
- Fill your freezer. Freezers operate most efficiently when full, and in the event of a power outage foods will stay frozen longer.

6. Window Film Checklist

- North or south facing windows are the easiest to shade. Compass north is not equal to true north. In Hawaii true north is 10^{o} East of magnetic north. Use a 70^{o} angle for overhangs over windows that face north (sun is higher in the sky in the north). Use 45^{o} angle for overhangs over windows that face the south (sun is lower in the sky in the south).
- Avoid West-facing windows unless you like the view, since it is difficult to block the afternoon sun. Likewise minimize East-facing windows, especially in hot part of the islands.
- Use vertical shades for east and west facing windows. Use horizontal shades for north and south facing windows.
- Vinyl or wood frames block heat gain somewhat better than aluminum frames. White frames are a little better because they reflect sunlight and stay cooler.

7. Room Air Conditioners Checklist

- Before installing A/C, check the recommendations for cool roofs, walls, windows, and natural ventilation. Do not air condition your home unless necessary.
- Compare Energy Guide labels.
- Insure easy access to A/C system for maintenance and repair.
- Periodically have contractor clean coils and check refrigerant charge.
- A/C system sized for efficient operation, not oversized). Proper sizing and installation saves 20% to 30% or more on A/C costs.
- Smaller A/C units don't cycle on and off so much, operate more efficiently, and generally provide better comfort and air quality. They also remove greater amounts of moisture from the air, reducing the risk of mold and mildew growth.

What capacity A/C (window or ductless split system) Do I Need?

Floor Area (ft^2)	Capacity (Btu/hr.)
150 – 250	5,000
200 – 300	6,000
250 – 350	7,000
300 – 400	8,000
350 – 450	9,000
400 – 550	10,000
500 – 650	12,000
575 – 800	14,000
750 – 1000	18,000

- Look for Energy Efficiency Ratio (EER) of 10 or higher. Look for Seasonal Energy Efficiency Ratio of 12 or better.
- Programmable thermostats provided.
- A/C units perform best when in shaded location.
- Consider units with multiple fan speeds and compressor for better overall performance.
- House meets Hawaii Model Energy Code standards for A/C buildings.
- House is Energy Star-compliant.
- Provide a drain for condensed water from cooling coil. Make sure drain pan empties/dries properly to prevent mold growth.
- Seal joints in walls, floors and ceilings against all moisture and air leaks. Use acrylic latex, polyurethane, or silicone-based sealants.
- Choose high-quality, low air leakage windows and doors and seal them with weather stripping.
- Provide alternate means to balance air flow (e.g. undercut doors, return air ducts). A/C system provides fresh air at 0.35 AC/H or 15 CFM per person.

As applicable:
Ducts in conditioned space or insulated to R-11.
Duct unions and joints sealed with low-toxic mastic and fibrous tape.
Duct blaster test conducted.

8. Residential Clothes Washers Checklist

- Use horizontal-axis, front-loading washing machines to save water and water heating energy. Recent research has shown that these machines can reduce energy use by over 50%, use significantly less water, require less detergent and shorter drying cycles, and reduce wear and tear on clothes.
- Rinse with cold water. Most people in the appliance industry agree that cold water washes just as effectively as warm. By eliminating warm rinse cycles, the average consumer will save about $25 per year with electric hot water, or $10 with gas.
- Adjust your load setting. Match the load setting to the size of the load. The load setting on your washer determines how much water is used. Smaller sized loads require less water.
- Eliminate small loads. Your clothes washer amount the same energy regardless of how much clothing is being washed. Washing two small loads uses about twice the energy as combining them into one full load. By combining loads together you reduce the number of loads you wash that in turn reduces your energy use.
- Use shorter washing cycles. Sort clothes by degree of dirtiness. Use shorter wash cycles for lightly soiled clothes.
- Soak your clothes first. Soak cycles can allow for shorter wash times. For heavily soiled clothes, instead of a heavy wash cycle, try soaking and then using a shorter wash cycle.